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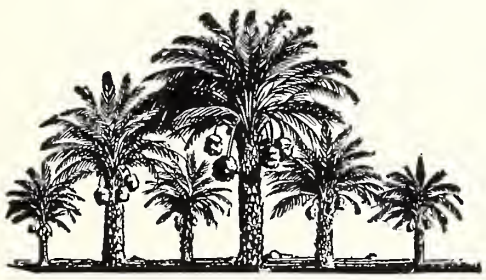

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PROBLEMS AND PROGRESS IN DATE BREEDING

By ROY W. NIXON and J. R. FURR

Crops Research Division, Agricultural Research Service
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Need for Variety Improvement

The California date industry is based on varieties imported as offshoots from the Old World. All have defects or drawhacks. Deglet Noor, which comprises about 80% of the total acreage, is an excellent variety from Algeria, but is very susceptihle to damage from rain and high humidity and has a narrow range of adaptation to climate and soil. Halawy from Iraq, a minor commercial variety of high quality, is nevertheless small and usually unattractive because of a tendency of ripe fruit to shrivel and to have dry, hard bases. Medjool, from Morocco, has been gaining in favor in recent years because of its large size and attractive appearance; however, its short, heavy fruitstalks cannot always be bent down to permit proper handling of the bunches.

Improvement of date varieties is important for competition with other fruits improved by hreeding. Competition from foreign dates may be reduced hy imposing tariffs or other restrictions, but any country that proposes to export dates must compete in quality and price in world markets. Some countries where dates are grown, but where inferior varieties predominate, have already learned that if better varieties are imported they will sell readily.

Economic conditions are forcing the mechanization of cultural and harvesting operations in dates; improved varieties, hetter suited to mechanization than those now availahle, are needed. For example, the long fruitstalks and relatively firm fruit of Deglet Noor are adapted to mechanized harvesting, hut the Medjool has the disadvantage of short fruitstalks and soft fruit. Time and uniformity of ripening may also be important for mechanical harvesting; although these are primarily varietal characters, they may be influenced to some extent hy pollen (8, 9).

Attempts to Improve Varieties

In the Middle East, where dates have been cultivated since the dawn of history, superior varieties have originated from chance seedlings as a result of natural selection aided hy man. In the Coachella and Imperial valleys of California, several new date varieties originated from seeds planted during the first two decades of this century and are now being grown on a small commercial scale. That hetter varieties could be obtained through a planned program of hreeding was suggested (4) as early as 1908.

The University of Arizona, in a study of inheritance in Deglet Noor begun in 1912, employed inhreeding hy crossing female seedlings with the best male seedlings of the same generation (2). Some ohservations on the inheritance of fruit color were reported (3), but none of the seedlings produced fruit equal to that of the Deglet Noor and after 3 generations the project was discontinued.

The El Arfiane station in southern Algeria conducted a date hreeding program for about two decades prior to the departure of the French personnel in 1962. The objectives were to produce a line of Deglet Noor that would breed sufficiently true to type so that propagation of the variety by seed would be feasible and to produce new varieties, particularly males that would flower early and others that would yield large quantities of high-quality pollen (5, 6, 11). A male that flowered in January was said to have been obtained from the first backcross of the Rhars variety, but no results with fruiting varieties have been reported.

Dr. A. T. El-Wakeel, Head of the Fruit Research Division of the De-

partment of Horticulture in Egypt, reported (personal Communication) in 1964 that a date breeding project has been underway at the Giza Experiment Station for 20 or 30 years, hut we have found no information ahout it in the literature.

U.S.D.A. Date Breeding Project

The U. S. Department of Agriculture's project, which until now has received only brief mention (10), was started in 1948. Because the date bears male and female flowers on separate palms and hecause pure lines do not exist, the first objective is to obtain males that approach the female parent in genetic composition. This is being attained by backcrossing to the female variety for 3 or more generations. Since 15/16 of the genes of a male from the third backcross to the variety Medjool as the recurrent parent, for example, would he from Medjool, the third hackcrossed male could he used in intervarietal crosses with reasonable expectancy that it would transmit mostly Medjool characteristics to its progeny.

In making selections for backcrosses, every available variety that possessed an outstanding character that might he desirable in a new variety was included. Primary consideration was given to fruit characters, such as large size, attractive color and appearance, good texture and flavor, good shipping and keeping quality, early ripening, late ripening, high yield, and rain tolerance.

Technique

In handling the air-horne pollen of the date palm, special care must be taken to avoid contamination. The procedure followed is essentially that described in studies of metaxenia, or the direct effect of pollen on the fruit (7, 8). The precautions involved bagging male spathes before they opened and selecting for pollination only unopened or hagged female spathes. When necessary to hold or to dry pollen hefore using, it was stored in separate rooms or containers. If pollen was not used during the current season, it was dried, placed in sealed containers, and stored under refrigeration (1). Between handling different pollens, the worker's hands arms and knife were washed with soap and water or sponged with 80% alcohol. Care was taken to avoid getting pollen on clothing or to change garments that were contaminated.

Although the first objective is backcrossing, in which the only seedlings used are males, all fruiting palms are examined each season and brief descriptions made of the fruit of any that seem promising. It is possihle that an outstanding palm, male or female, may appear in any lot of seedlings. Palms with poor fruit or undesirahle vegetative characters are removed to favor exposure and growth of those retained.

Initial Plantings

The seeds resulting from 108 pollinations made in 1948 and 1950 were planted in 1951 at the Southwestern Irrigation Field Station, Brawley, California. Some of the female varieties were pollinated with pollen from unrelated males, but pollen of available males of known parentage was used for pollinating the varieties from which the males were derived, thus a few first backcrosses were made.

More lots were included in the first plantings than could be carried as hreeding lines, and some were eliminated. By 1955, 35 varieties represented by 48 breeding lines—1 in each of 27 varieties, 2 each in 5, 3 each in 2, and 5 in 1, had been selected for inbreeding.

Some miscellaneous lots of seeds were included in the breeding program, usually representing outstanding varieties not found in the United States and of possible value in breeding. These, of course, could not be backcrossed, but selections from them may provide a source of genetic characters not present in available varieties.

Beginning in 1955, and as they flowered in succeeding years, males at Brawley were backcrossed to their female parents. The seeds were planted at the U. S. Date and Citrus Station, beginning in 1956, and at the Brock Ranches East Mesa Research and Experimental Farm in Imperial Valley beginning in 1959. The latter plantings were made possible by Warren H. Brocl who operates the East Mesa Farm and whose generous cooperation in providing space and care is hereby gratefully acknowledged.

PROBLEMS

Time

The most serious drawhack in date breeding is the time required. The earliest backcrosses, 13% of the total number, were made the fourth year after planting seed. Twice as many (26%) were made the 5th year, but the average cycle from seed to flowering of 46 hackcrosses made from 1955 to 1964 inclusive was 6.5 years. Even if only 5 years are required for a hackcross, to make 3 hackcrosses and a first selection from an intervarietal cross will require at least 25 years.

When a promising selection is made there is still the hottleneck of vegetative propagation, which in the date palm can he accomplished only hy means of offshoots. A minimum of 5 years after planting is required hefore the first offshoot of a seedling can he rooted, cut and planted and several more years elapse before other offshoots produced by the palm can be removed. Thus, at least 30 years may he required to make 3 backcrosses and obtain the first offshoot from an intervarietal cross. The number of offshoots produced by a date palm is primarily a varietal character, ranging from about 5 to 25. To obtain enough offshoots for small-scale commercial tests, or for tests in different localities, additional generations are required. Moreover, a palm does not reach full production until it is 10 to 15 years of age. It is therefore not surprising that few attempts have been made to breed new varieties of dates. Promising palms, however, may appear in any generation of seedlings and these can be propagated for testing long before the final objectives of intervarietal crossing are reached.

Flowering Pattern

A few seedlings may flower the 3rd year after planting and possibly 20% to 30% in the 4th year, but these early inflorescences are small and many have little or no pollen. Usually, in the 5th or 6th year, as the palms and inflorescences increase in size, viable pollen is produced. The early, small female inflorescences, however, usually set fruit if pollinated.

Of the first lot of 424 palms grown from seed planted at Brawley in 1951, 77% had flowered hy June 1955, when the palms were 4 years old. Two years later only 9% more, or a total of 86%, had flowered. The next lot of 343 palms from seed planted in 1953 did not do so well. Only 41% flowered by June of the 5th year; 3 years later a total of only 67% had flowered.

At East Mesa, of 613 palms from seeds planted in June 1959, 74% had flowered 5 years after planting. Of 272 palms from seeds planted in June 1960, 61% had flowered in 4 years. In addition to slowness in flowering, another cause of delay in backcrossing is the flowering of young seedlings after the blooming period of the old palms is past, which necessitates holding pollen for another year.

Progeny Required

The size of the seedling population must allow for the dioecious character of the date palm. In these experiments, males outnumbered females by 5% to 10% in every progeny of 100 or more seedlings. For example, in a lot of 318 flowering seedlings, 56% were males and 44% were females, but out of a final total of 745 flowering in the entire planting, 61% were males and 39% females. At East Mesa 611 flowering palms produced 58% males and 42% females. A small percentage of seedlings may he hermaphroditic in the first year of flowering; sex is usually definite thereafter, though a few cases of sex reversal have heen recorded.

In many progenies at Brawley there were only 5 or 10 palms; in some instances these proved insufficient for backcrossing. For example, in one line (L-1, Amber Queen) of 5 palms only one, a female, flowered. In another line (L-2, Amir Hajj), of 10 palms, 8 flowered, but only 1 was a male and it was sterile. In each of 4 other lines only 1 of 5 palms proved to be a male and it was sterile. The most unusual case was that of the variety Deglet Beida; 5 palms in each of 3 different lots were represented, each lot originating from a different male parent. In one lot all the Deglet Beida seedlings proved to be males; in another there were 4 males and 1 female; in the 3rd only 2 palms flowered, 1 male and 1 female. None of the male seedlings of Deglet Beida produced pollen, although they were more vigorous and larger for their age than most of the others in the planting and produced large spathes of normal appearance. Larger progenies might have yielded some fertile males.

In making backcrosses we planned to mix the pollens available in each progeny, but in most cases because of the small number of males and variations in time of flowering, the first one to produce good pollen was used to be sure of getting a backcross that season.

One problem in backcrossing is that the fruit characters carried by the male are unknown. Some idea of the transmittal of fruit characters by the male may be obtained from a study of its female progeny. This is planned for intervarietal crosses. However, to test all males in each generation before making another backcross would be prohibitive because of time and space. There is justification, however, in giving some weight to the character of the females in a progeny, and in selecting males from the best progenies.

PROGRESS

Because seedling males of known parentage were available, it was possible to start the program with the first backcross in 14 lines representing 9 varieties and with the second backcross in 1 line of Deglet Noor. Of the 48 lines initially selected, 17 had advanced to the 1st backcross, 11 to the 2nd, 8 to the 3rd, and 2 to the 4th by 1964. No backcrosses were made in 7 lines and 7 others were dropped.

The best males from each backcross are being saved, at least until better males from a later backcross become available. Males are selected on the basis of good flower characters and resemblance of leaf characters to the female parent in hopes that there may be some linkage with fruit characters. Any male considered to be desirable for intervarietal crosses may be selected and propagated. It is also desirable to test male selections for the effects of their pollen on the size and time of ripening of the fruit developed from the flowers pollinated, i.e. the metaxenia effect (7, 8).

Intervarietal crossing, the second objective of the breeding program, was not attempted until 1961, when the Barhee and Dayri varieties were pollinated by a male from the 3rd backcross to Deglet Noor. In 1964, 8 intervarietal crosses were made: pollens from 2 males of a 2nd backcross of Medjool (Nos. 55-98-13 and 55-98-17) were each applied to Deglet Noor, Halawy, and Abbada, and 1 (55-98-13) to Barhee. Medjool was crossed with a 4th backcrossed male of Deglet Noor (60-273-14). An increasing number of such crosses can be made as more advanced backcrossed males become available in other lines.

Among the backcrosses at Brawley, 1 female seedling of Amir Hajj and 1 of Medjool were selected for further observation. Among the backcrosses being grown at Indio, and especially at East Mesa where the number of progeny in all lines is much larger than at Indio, several seedlings of the 1st and 2nd backcrosses of Medjool are considered promising because the fruits are of large size, attractive appearance and good quality.

OBSERVATIONS

Although detailed genetic studies were not undertaken, some observations on the behavior of seedling palms and the inheritance of characters have been recorded and may be of value in future planning. It is probably true that the chances of finding 2 seedling date palms exactly alike are almost infinitesimal, but, in spite of their variability and inferiority, emphasized so much in the literature, an impressive similarity to the parent variety has often been observed. If allowance is made for differences in adult and juvenile palms, seedlings have usually developed enough vegetative characters after the third or fourth year of growth to permit valid comparison with the seed parent. One familiar with a variety may detect similarities in such characters as color of foliage, curvature of leaves, and type and arrangement of pinnae and spines. All palms that were large enough were rated for overall resemblance of vegetative characters to the female parent according to the following: little or no resemblance—1, moderate resemblance —2, strong resemblance —3. The sum of the ratings of all the progeny of a given lot or line divided by the total number of individuals provided an average rating for that group of palms. Admittedly this is a crude index, but in the absence of more detailed studies it may be of interest to students of the date palm.

Table 1. Ratings of date seedling progenies for resemblance to the female parent.

Rating	Female parent	Line (L) or accession number	Generation	Number of seedlings
2.7	Barhee	55-102	BC 1	23
2.7	Barhee	55-103	BC 1	24
2.4	Medjool	L-31	BC 2	39
2.4	Menakher	L-34	BC 1	22
2.3	Thoory	L-42	BC 2	40
2.3	Medjool	L-30	BC 2	27
2.2	Medjool	L-33	BC 1	26
2.2	Medjool	58-380	BC 1	23
2.2	Dayri	L-7	BC 1	39
2.1	Khadrawy	L-20	BC 2	22
2.1	Amir Hajj	58-381	F1	30
2.1	Ammary	58-382	BC 1	18
2.0	Barhee	L-6	BC 2	23
2.0	Kustawy	L-27	BC 1	42
2.0	Hayany	L-15	BC 1	26
1.9	Zahidi	L-44	BC 1	29
1.9	Deglet Noor	L-11	BC 3	37
1.9	Halawy	L-14	BC 1	39
1.8	Rhars	L-36	BC 1	24
1.8	Khir	L-23	BC 1	24
1.8	Khalasa	59-234	F1	25
1.8	Koroch	L-24	BC 1	13
1.7	Amir Hajj	L-3	BC 1	27
1.5	Saidy	L-46	BC 2	19
1.1	Khadrawy	L-21	BC 2	24

With only 5 or 10 palms in a lot, average ratings were too variable for valid comparisons. Therefore, only the first plantings at East Mesa, where the average number of progeny was 26, are considered here. Progenies with more than 10 palms each are listed in descending order of ratings in Table 1. Of 25 lots representing 18 varieties, average variety resemblance ratings ranged from 2.7 to 1.1 and 15 were 2.0 or above, indicating definite resemblance to the female parent. The average rating of the 10 lowest was 1.7.

Resemblance to the female parent varied among different lines derived from the same variety, differences which in some cases could be attributed to the male parents. Thus of 2 Khadrawy backcross progenies, one (L-21) was the lowest, 1.1, and the other (L-20) was above average, 2.1. The highest ratings were those of 2 Barhee progenies, both first backcrosses (55-102 and 55-103) and both 2.7; but another Barhee progeny, a second backcross (L-6), was 2.0. Next to Barhee, Medjool was outstanding with 4 lots all rating between 2.4 and 2.2. The rating of 1.9 for the third backcross of Deglet Noor (L-11) as compared to higher ratings for the first backcross of several other varieties suggests that the tendency to resemble the female parent is stronger in some varieties than in others.

Barhee seedlings have been conspicuous for the glaucous, light green foliage; broad, green leaf bases; slightly to moderately arched, spreading leaves; and vigorous growth — all characteristic of the parent variety. With one exception the fruit of Barhee seedlings has been remarkably similar to that of the parent variety in the yellow color of the khalal, rounded-ovate shape, relative absence of tannin or astringency in the khalal stage, flavor of the ripe fruit, and late ripening. The exception was noted at Brawley in the initial planting of 6 different progenies of Barhee, each from a different male parent. One male (R-6) was from a first backcross of Deglet Noor. Out of 9 Barhee seedlings from this male, 4 were females and all had light red fruit in the khalal stage; 3 of the 4 had considerable tannin. Fruit of Deglet Noor is light red in the khalal stage and, like nearly all date varieties, very astringent. Red khalal color, however, has not been characteristic of later backcrosses in this line.

Characters of Medjool that have been pronounced in the seedlings are the dark green color of the foliage, leaves with little curvature, and broad stiff pinnae set in closer angles to the rachis than in Barhee and other varieties. An outstanding character of Medjool is its large fruit and this character appears in many of its female progeny. Several promising seedlings have been selected for further testing.

Among Khadrawy seedlings distinctive characters are the bright green color of the foliage and leaf bases, and moderately arched leaves with a tendency for the pinnae to be more in one plane, or set at less divergent angles with each other, than is common in other varieties. Early flowering and early ripening of the fruit prevail; fruit often resembles the female parent in size and character.

The inheritance of unique characters has sometimes been observed. The "Khir", or "Gharra", variety, grown near the Persian Gulf in Saudi Arabia, has a fruitstalk from which the fruit-bearing strands usually branch from one point at the distal end and not from a 10 to 20-inch extension of the fruitstalk as in nearly all other date varieties. Its fruit is also unique in that the seed is very close to the distal end rather than near the base or the middle of the seed cavity as in other varieties. Both these unusual characters heve been observed in Khir seedlings.

While the tendency of seedlings to resemble the female parent is more pronounced in some varieties than in others, in any group of 25 or more seedlings some are almost certain to resemble the parent variety in fruit or foliage or both. In one experimental planting of dates made from seeds originating at the U. S. Date and Citrus Station the recipient reported (12) that "the seedling palms reproduced the recorded parental characteristics with marked uniformity" and "it would appear that with controlled pollination it might be feasible to establish commercial groves from seedling material."

SUMMARY

In 1948 a breeding project was begun at the U. S. Date and Citrus Station to: (1) produce, by backcrossing, males that are similar in genetic makeup to the parent variety; (2) use males from advanced backcrosses for intervarietal crosses to produce new and better fruiting varieties; and (3) select superior seedlings, male or female, that appear in any generation and that have possibilities as new varieties.

The chief problem is the time required. Few backcrosses can be made in less than 5 years from seed and more often it is longer. From half to three-fourths of the seedlings may flower by the beginning of the 5th year, but the first male inflorescences are small and often sterile. Flowering frequently occurs so late in the season that pollen must be held until the next year before it can be used on the recurrent parent. Once a selection is made, its testing, as compared with other fruit crops, is greatly delayed because date varieties cannot be budded or grafted, but are propagated vegetatively only by offshoots.

Progress through 1964, with 37 breeding lines representing 28 varieties was as follows: 17 lines were advanced to the 1st backcross; 10 to the 2nd; 8 to the 3rd; and 2 to the 4th. Among the backcrosses, several female seedlings have shown sufficient promise to justify further testing. Intervarietal crosses were begun with 2 in 1961 and 8 in 1964. As more advanced backcrossed males of different varieties become available, more intervarietal crosses for specific objectives will be possible.

LITERATURE CITED

1. *Aldrich, W. W. and C. L. Crawford.* 1941. *Second report upon cold storage of date pollen. Date Grower's Inst. Rpt.* 18: 5.

2. *Freeman, G. F.* 1910. *Dates. Arizona Agr. Exp. Sta. An. Rpt.* 21: 384-385.

3. *Freeman, G. F. and W. E. Bryan.* 1917. *Dates. Ariz. Agr. Exp. Sta. An. Rpt.* 28: 455.

4. *Mason, S. C.* 1908. *Date Growing in Southern California. Official Report of the 34th Fruit Grower's Convention of the State of California;* 170-178, *Sacramento.*

5. *Monciero, A.* 1949. *Rapport sur l'orientation de l'agriculture et le problème experimental en agronomie Saharienne. (9 pp. mimeographed.) Paper presented at Congrès de la Production Dattière,(Compte Rendu in-extenso.) Touggourt, les* 4, 5 *et* 6 *Avril.*

6. *Monciero, A.* 1959. *Le palmier dattier au Sahara. (9 pp. mimeographed.) Paper presented at the First International Technical Meeting on Date Production and Processing, Tripoli, Libya,* 5-10 *December.*

7. *Nixon, R. W.* 1926. *Experiments with selected pollens. Date Growers' Inst. Rpt.* 3: 11-14.

8. *Nixon, R. W.* 1928. *The direct effect of pollen on the fruit of the date palm. Jour. Agr. Res.* 36: 97-128.

9. *Nixon, R. W.* 1931. *The commercial utilization of differences in time of ripening of dates due to pollen. Date Growers' Inst. Rpt.* 7: 4-5.

10. *Nixon, R. W.* 1959. *Pollination, breeding and selection of date palms. Background Paper on Date Production*: 22-41. *(Mimeographed.) First International Technical Meeting on Date Production and Processing (Tripoli, Libya.) Food and Agr. Organ. United Nations, Rome.*

11. *Pereau-Leroy, P.* 1951. *Experimentation sur le palmier-dattier en Algerie. Fruits d 'Outre Mer.* 6: 238-240.

12. *Richardson, A. M.* 1952. *The Rayford Park date grove. Queensland Agric. Jour.* 75 (5): 253-262.

Panel Discussion of Labor-Saving Devices in Pollinating Dates

PANEL MEMBERS

Walter E. Geissler (California Date Growers' Association)
Richard D. Preston (California Date Growers' Association)
Tellis Codekas (Date Grower)
Leonhardt Swingle, Leader, (Date Grower)

L. Swingle—The Date Committee considered that 1965 would be a critical year for the date industry due to the short, uncertain supply of labor. Pollination would be the first operation affected; so it was decided to discuss that phase of the industry, and it was hoped that labor-saving methods would be emerging that could be put into general practice next year.

The season was late, and the weather was such that there was no big burst of bloom and a general crisis did not occur. The blooms came on in an orderly manner, and a great many could be pollinated the first time the palm was climbed; so the work went better than expected with short help. It is too early to have results on some of the new methods that were tried and we do not know even yet the general set of the crop.

W. E. Geissler—This season the weather was favorable for labor saving; because of the unusually cool spring the bloom was late. Usually in the upper part of the Valley bloom begins in early February, but this year it began a month late and inflorescences were not ready for pollination until nearly the end of March. Then in the upper and lower parts of the Valley, when the weather got warm, bloom came out all at one time and 50 to 75% or, in rare cases, all of the blooms were ready for pollinating at one time. We tried to open as many spathes as possible this year at each trip up the palm. Spathes 12 to 14 inches long were opened and the flowers pollinated. We will not know the results for 3 or 4 months, but the cost of pollinating this year will be less than for the last 2 years. The larger the number of blooms per tree that can be pollinated at 1 time, the lower the cost will be. The result of opening immature spathes is still uncertain; cold weather, wind or rain could affect them.

R. D. Preston—A trial of pollination by helicopter had to be abandoned for this year because of late arrival of the helicopter and malfunctioning of the hopper that held the pollen and diluent. The trials last year with a fixed-wing aircraft showed that the kind of diluent (walnut-hull dust and wheat flour) used did not affect the results. In 1963, pollination by aircraft had given good sets of fruit in the middle of the flowering season and poor sets early and late in the season. In 1964 in 1 garden pollinated early the percentage fruit set was consistently high, but in midseason aerial pollination gave very erratic results: 5 to 90% fruit set. Aerial pollination late in the flowering season also gave erratic fruit sets. In 1 hand-pollinated garden early and late pollination also showed erratic response.

Pollination was carried out in 3 gardens. The first garden pollinated had an estimated fruit set of 46.9% of normal. The garden that was hand pollinated early and late had an average set of 38.7%, and the 1 that was pollinated only by air had a set of 39.2%. This year we had 10 over-flights, but pollination was not improved over that of last year. My opinion is that part of the trouble results from slow emergence of the bunch out of the spathe; part of the flowers are exposed to pollen and part remain covered too long for pollination to occur. We hoped that use of the helicopter would enable us to put more dust into the crown of the trees where the inflorescences are emerging from the spathes and thus obtain more effective pollination of flowers while they are in the receptive stage.

T. Codekas—This year because of the labor situation we decided to have pollination done on a piecework basis. We found that the men paid 5½ cents per inflorescence more than doubled the output per man as compared to last year when they were paid on an hourly basis. The bloom was delayed and when the inflorescences did begin to open, many opened at once. In 1 garden we pollinated an average of 8⅔ blooms per tree at 1 time by opening all that we thought were mature enough to pollinate.

Last year we placed paper bags containing pollen over unopened inflorescences to see if pollination would be affected when the spathe opened, but it failed completely. This year we covered some unopened spathes with long plastic bags with pollen in cotton balls which were fastened inside the bags. Metal rings were attached to the mouth of the bags to hold them down so that the bloom will grow into the bag. Ventilation holes made in the polyethylene bags allowed rain to enter and wet the pollen, which in some cases became moldy. Covering the spathe with a polyethylene bag fitted with a metal ring was not primarily for pollination, however; the principal object is to keep the fruit strands from becoming entangled in the fronds as the fruitstalk elongates and the fruits enlarge and weigh the bunch down among the leaves. The purpose of the metal ring is to hold the bag down so the spathe will grow into the bag. The bag will presumably be lifted with the inflorescence as it grows, and the bag and ring will keep the strands confined so that eventually the bunch may be thinned and tied down as though the strands had been held together by the usual string fastened around them with a slipknot. The metal rings could be collected at harvest time and re-used.

Q: Why use polyethylene bags?

T. Codekas: They are easy to get and would be protective later in season.

Q. When do you plan to thin?

T. Codekas: Sometime next month, at regular thinning time when tying down. Then the bag would be fastened and the bottom cut.

Q: Could paper bags be used?

T. Codekas: Paper bags are too bulky.

L. Swingle—Leland Yost and others have been using a device for blowing pollen into the bunches, especially soft varieties, for several years. This has been described in the 29th Date Institute Report by D. B. W. Alexander. This will save much time in pollinating, but unless there is a prompt follow-up in tying the bunches, the dates become all tangled in the leaves and more time is lost in tying down and thinning than is saved in pollinating.

We have watched this method closely for several years, and while serious trouble can develop without a close follow-up in thinning, we believe this method might be very important to carry the regular crew over a sudden and heavy burst of bloom. All at once the weather may bring on blooms all over the garden and the regular men are hopelessly behind. If this peak of bloom

can be pollinated by this method, or by airplane, while the crew keeps right on tying down the hunches, the crop may be saved and the work done with a smaller crew. As a regular practice on Deglets, we doubt that this method really saves any time, but it might easily carry one over an emergency.

T. R. Brown—Several members of our crew have heen with us for years and were accustomed to working at the hourly rate of pay rather than by piecework. I proposed pollinating by piecework, but the men declined; so our garden was pollinated at the hourly rate of $1.50.

Our date palms range from 20 to 40 feet in height, and all hut a block of Barhees and young Medjools are provided with permanent ladders. The pollinating job included clipping strand tips and flower stems except those of small, late bunches. The men also gathered male flowers each morning.

To date our crew has pollinated 24,384 bunches with 1,080 man hours of labor, or 21.6 bunches per hour. The cost per bunch compares favorably with the price set by the field committee of the California Date Growers.

Q: Does the length of the strand and whether the fruits are on the upper or lower end of it make any difference in the size of the fruit?

R. W. Nixon: In our experiments it hasn't made any difference if you reduce the dates to the number that the strand can mature properly. However, if you have too many dates on a strand, those nearest the fruitstalk will be normal and well developed, but those at the outer end near the tip will be small and tend to shrivel.

Q: Is this true for Medjool, too, and could you just shorten the strand?

R. W. Nixon: With the Medjool you have another problem hecause it is such a big date. It does not have quite as long a strand as the Deglet Noor and if you shorten it, then the dates are crowded and that is the very thing you don't want. You want space between them so there is no crowding, mashing, or malformation.

L. Swingle: What you need on Medjools is a poor set!

Q: Did the Experiment Station try out mechanical thinning?

R. W. Nixon: If you mean with chemicals, some experiments were reported last year hy J. R. Furr and A. A. Hewitt. One of these, elgetol, looks promising and Furr is continuing experiments with it. There was some damage to the fruitstalks and further work will have to be done before any recommendations can be made.

Q: Can the machines for putting men into the trees be used successfully for pollinating?

W. E. Geissler: Yes, we can get them up into the trees easily. Use of the machines instead of ladders does not save money, but many workers who will not climb ladders will ride the basket or cage into the tree. Some men, however, are afraid to climb from the cage into the crown of the tree.

Q: Is the pollination as well done when paid for by the piece as by the hour, and is there a tendency to report incorrectly the number of bunches pollinated?

W. E. Geissler: We supervise the work carefully, but the quality of piecework is poorer and the reports of bunches pollinated may be 5 to 15% high.

Q: If piecework increases productivity 50 to 100%, will we need supplemental labor next year?

T. Codekas: This year we were aided by unusually favorable weather. I think we will be short of lahor again next year unless we build up crews between now and next pollinating season.

W. E. Geissler: I agree. Most of the men prefer to work on the ground, even for less pay. I don't think piecework will increase efficiency 50%.

T. Codekas: I douht that our men last year pollinated over 250 blooms per day, but this year they averaged 500 or more. George Leach has been pollinating by an average of 2½ trips up the palm per season, but if you climh the trees 5 or 6 times a season, you can't pollinate 300 per day.

L. Swingle: I believe that it is possible to pollinate the crop by pollinating only twice per season.

Swingle closed the session by reading what Herodotus wrote 2,400 years ago about date pollination in Mesopotamia: "Palm trees grow in great numbers over the whole of the flat country. . . . The natives tie the fruit of the male palms, as they are called hy the Greeks, to the branches of the date-bearing palms, to let the gell-fly enter the dates and ripen them and prevent the fruit from falling".

Panel Discussion of Labor-Saving Devices in Harvesting Dates

PANEL MEMBERS

Tellis Codekas (Date Grower)
Leonhardt Swingle (Date Grower)
Richard D. Preston (California Date Growers' Association)
Edward E. Smith (California Date Growers' Association)
David Mitchell, Leader (Date Grower)

D. Mitchell — Several growers and packing houses have developed labor-saving machines or methods. This year especially we need to learn about existing machines and to develop others to overcome the labor shortage.

L. Swingle—Mr. Ivan Eastes and I have discussed mechanical harvesting since its inception and reached the conclusion that it would be possible to develop a one-man, or rather a one-date-garden, method. We had the details pretty well worked out for 1963, but that fall I lost most of my crop by rain and could do nothing then. Last fall I put it into operation and picked most of my dates on one place by this method—about 200,000 pounds.

It required three pieces of equipment, a "limb-lopper" operated by compressed air, an air compressor to operate it, and a tractor with a lift to carry the bins from palm to palm. The bins do not have to be lifted high enough to he placed on a truck; the trucker can do that.

The "limb-lopper" comes with a saw which is replaced by a ring 6 to 8 inches in diameter. At the start we had this ring made as 2 prongs which could be slipped on the stem of the bunch, but vibration was so great that the prongs would actually sing and then would crystallize and break every day which meant a trip to the welder and a shut down. Changing the prongs into a ring and cutting the stem of the date bunch short allowed the ring to go over the stem and be brought down on the bunch very quickly and no time was lost through breakdown in the vibrator.

A 4-man crew could operate it efficiently. Two men cut the bunches off the palm and lowered them into empty bins at the base. Two men on the ground were needed to shake off the dates into the bins and move the bins and equipment. The man with the vibrator would come up to the bin containing the date bunches, put the ring over the stem and then, holding the date bunch with 1 hand, would lower the vibrator down over the dates and in a matter of seconds they were off. The cleaned bunch was thrown on the ground and another worked. In a few minutes the palm was picked. As it would take 3 or 4 palms to fill a bin, there was considerable moving and filling of bins and hence the need of 2 men on the ground.

I was well satisfied with the operation and at the end we were making good time. I had to start with 1 man and develop procedure and get a crew organized and at the end we were going very much faster than at the start. The total lahor cost from the very beginning to the end was a little over a half cent a pound which was very good considering we had to start with no experience with the machine.

R. D. Preston: As a result of work done by California Date Growers' Association on mechanical harvesting of dates, I concluded that we should concentrate on removing fruit from the bunch rather than on removing the intact bunch from the tree. Objects were greater flexibility and mobility of required machinery. Prior to 1963-64 we had experimented with a knocking device such as that described by Mr. Swingle. It was operated by compressed air, hut maintenance difficulties necessitated improvements.

University of California engineers had been working on the theory that a vertical shaking motion was most efficient in removing fruit from the bunch. Our machine delivered a horizontal oscillation. We felt that whichever type was used we should be able, with a crew of 4 men on a vehicle carrying 2 booms, to harvest 25,000 to 30,000 pounds of fruit per day.

In the fall of 1964 we hegan 2 testing programs: 1 using the knocker and the other involving the harvest of entire bunches. One problem with the latter method was that we did not have a good way to convey the fruit from the tree to the bin at ground level. It was difficult to collect many bunches at the top of the hoom because the weight limit was quickly exceeded. Difficulties encountered with the shaker device were breakage of a flex-drive cable that transmitted the shaking impulse and rapid deterioration of the electrical controls. We found it possible to reduce this difficulty by removing the electrical controls from the hydraulic mechanism and placing them on the operator himself. Other sources of difficulty were the hydraulic valves and the solenoids that governed them. Such delays affected the entire crew of 4 or 5 men, reducing their average daily production considerably.

Problems with the bunch-harvesting device were equally trying. We could not integrate the operation of the collecting baskets at the ends of the booms with that of the hopper and shaking device we had mounted on a trailer. We tried several things. At one time we even had a man sitting rather free in space in a seat at the apex of the boom. However, the operator felt even more insecure than a man on a ladder and we had to abandon this idea. Finally we took one of the old metal baskets from one of our former machines and placed it at the end of the hoom. A man in the basket accumulated bunches in the bottom of the basket. It was then brought down to the hopper and dumped. It placed more weight on the boom than was safe, but trials were so encouraging we sought ways to use the method. The first week we averaged 35 to 40 bins of 900 to 1,000 pounds of fruit per day. This compared with an average of 15 to 20 bins per day with the shaker at the end of the boom. As a result of the overloading of the crane the brakes on the hoom would not hold at times and required frequent overhauls.

We continued to employ both methods during the season. We found that with a ready supply of spare parts and a 2-man crew we could reach 25 to 30 bins a day with the hoom-mounted shaker. With our bunch-harvesting system, production continued to increase. On several days in gardens with plenty of ripe fruit we harvested 60 to 65 bins of fruit per day. The advantages of this system becoming more and more evident, we increased the crews to 4 men.

We still have some troubles with the system. There are some wear points on the crane itself. The motor that provides the power for lifting the basket is overspeeded when the weight is brought down. It was necessary to replace this with a hydraulic mechanism which gave more rapid action and better control. Another tube has been added to the booms, and wear surfaces have been refinished and new rollers provided at spots where trouhle was encountered.

Time studies run hy the University showed that the greatest loss in efficiency was at the shaker rather than in the operation of the booms. By adding one more man to the shaker device we achieved some improvement. Considerable savings result from having the two booms on one vehicle. In small enterprises these savings may not be obtainable or as important.

We also continued work with the Barton-type machine which propels itself and has an articulated boom. Especially smooth ground is required for its operation and it is limited as to the height at which it can operate efficiently. Our tallest Barton tower will reach up to 40 feet which is not high enough in many gardens. However, it is useful in smaller trees and we will continue to use it. Last season 2 units, using a 3-man crew, harvested ahout 1,500,000 pounds of fruit.

Q. How is the crew set up on the Barton unit?

A. One man does the cutting in the basket. The driver sits at the base of the machine where he maneuvers the basket into position. The third man operates a truck-mounted shaker. This year we may go to a trailer-mounted shaker. The basket is dumped into a hopper near the shaker, and the third man shakes the fruit into bins which are tipped onto the truck or trailer.

Q. When you are bunch harvesting, do you always bring the hunch down in the basket?

A. Yes, the fruit stalk is cut from the tree and the bunch dropped into the basket in which the man is standing. The basket has two levels: the upper portion on which the man stands and the bottom portion which holds the fruit. It has homh-hay-type doors at the hottom.

Q. While watching the harvest hy these machines, I notice a lot of time is used in lowering and raising the hasket. Is it correct that even so this still works hetter than the shaking in the tree?

A. I thought originally that time could he saved by handling the fruit only once; however, it is slower to do the shaking in the tree than on the ground.

Q. What ahout the lahor cost per pound harvested?

A. The cost of a unit that will harvest ahout 60,000 pounds of fruit is $23,000 to $24,000. Roughly, the way we figure depreciation, overhead, etc., the cost is ahout seven-tenths of a cent per pound.

Q. Is the hunch harvesting method hetter than the Barton hoom method?

A. I think we are reasonahly sure now that the telescoping boom rig is superior, for our purposes, to the Barton articulated-boom method. The telescoping boom is unlimited as to height; we now have a model that extends to 65 feet. Maneuverability of the telescoping model in the garden is also superior. The Barton boom disturbs the ground more and makes more trouble for the grower. We still would like to see growers improve the ground surface even for our more maneuverable rigs. I recommend the flat-basin, permanent-border method of irrigation. This gives less wear and tear on our machines.

Q. What about using three booms on low trees?

A. We can harvest trees as low as ten feet, but it is not practical to do so. We find the most efficient working height to be between 25 and 40 feet. With trees of greatly unequal height it is advisable to work only two trees at a set because of difficulty in maneuvering the basket into position. It is on the low trees that the Barton crane really becomes useful because the articulated boom makes possible rapid moves into position.

Q. Do you have any more ideas for experimentation and improvement this season?

A. We plan to develop more shaker capacity by employing 2 shakers and 2 men with each unit. The man we add will not be shaking all the time. He will be free to move off the rig to help load bins and do other work. We are also going to add a hydraulic ramp to the crane to improve maneuverability and double the brush area of the motors. We think that increasing brush area of the motors will make them run longer without repairs and should result in less voltage drop. We are still searching for a suitable light-weight material for the baskets that will increase their pay load.

Q. Do you think these units have about a 10-year life?

A. We can't estimate their life yet. The normal use of this crane on other jobs has involved much less intensive use than we are giving it. Some cranes under these conditions have heen active for 12 to 15 years. However, we noticed that after 3 or 4 months under our conditions wear exceeded that under more normal use. We raise and lower these baskets about every 6 minutes day in and day out. We think now they may last 4 or 5 years.

Q. Have you developed any data on the question as to when the increasing height of the date palm makes it unprofitahle?

A. We don't have the answer to this. We know that costs of handling go up with increasing tree height, hut at the same time fruit quality and quantity actually seem to increase. I think we will find tools to make it feasible to handle palms of any height so long as they are producing fruit of good quality in sufficient quantity.

Q. How many machines are you using?

A. We are now using 5 units with 2 cranes on each in addition to 3 of the Barton self-propelled units. We never have more than 2 of the latter in the field at 1 time hecause of repair problems.

Q. Is that the total of the machines in use in the Valley?

A. No. George Leach has a telescoping-boom apparatus mounted on a tractor. The Codekas brothers have their own tower. Mr. Swingle and, perhaps, others have old machines they have operated for some years. It would probably take another 5 to 8 units using the 2 booms each to handle the entire crop.

Q. Does this mean to handle all dates or just Deglet Noors?

A. We are only talking about Deglet Noor.

Q. What is the matter with Zahidi for mechanical harvesting?

A. It is possible they could be handled by our machines, but I am not sufficiently familiar with this variety to be sure.

T. Codekas: About 5 years ago the Date Administrative Committee became interested in seeing what effect mechanical harvesting was going to have in the plant and on the use of containers such as bins for bulk handling. We had an old hydraulic tower on which the engineers (G. K. Brown and R. M. Perkins) mounted the shaker they had developed. The harvesting machine was made entirely hydraulic and one shaker was mounted on it. The axles are 20 feet wide, on their ends are 2 vertical hydraulic ramps that extend up 45 feet to the bottom of the platform, which is really a trailer pulled by a tractor. Power for the hydraulic units is furnished by the power takeoff on the tractor. Though the overall width of the machine is 23 feet, it was moved from garden to garden over the highway with no difficulty.

Last season with this machine we harvested 891,000 pounds of dates, averaging 48,609 pounds per day, or 5,481 pounds per hour. This includes down time, moving time and servicing time. We used 7 men: a tractor driver, 4 men in the palms, 1 man on the shaker, and 1 man on the ground to move hins and perform other operations.

The hydraulic ramp goes up under the bunches, and catwalks go on each side of the palms. We had 4 men on each catwalk, 2 men working on each palm. We found

that one shaker was inadequate so we will add another shaker, hut no more men will be required to operate the machine. The quality of fruit harvested by hand and by machine was about the same.

Q. Do you recall exceptionally high rates of harvesting on certain days last year?

T. Codekas: On 1 day 10,000 pounds an hour, 70,000 pounds in 7 hours. It got too windy in the late afternoon to work. That was douhle the average rate because you have loss of time for moving and repairs. The first year we had a lot of problems, hut this year we had few maintenance prohlems, practically trouble free. The machine worked very well but was not maneuverahle. The shaker is between the 2 hydraulic ramps. The machine carries its bins which are lowered to the ground automatically. We developed it for bins before they were in common use. We had to get grapefruit bins to try out the use of bins. We used to have 3 men loading boxes on the truck. Now with a fork lift that cost ahout $400, one man—the driver—goes to the field, loads the truck and takes it in by himself. The forklift is easy to move and handles fruit faster. With 2 trucks and 2 drivers and no swampers, 50,000 to 60,000 pounds of fruit a day were handled in bins.

D. Mitchell: After the old way, it is amazing to see harvesting done with the Codekas machine.

For our own use, I huilt a simple unit hased on the shaker developed hy the University. It is a 2-wheeled trailer that will hold 3 bins and is pulled hy a tractor. The unit is powered hy the hydraulic system on the tractor. Four men with ladders and picking saddles climb 4 trees, cut bunches, leaving ahout 4 inches of stem, and lower the hunches by ropes, with hooks attached, to 2 men on the ground. The ground men carry the bunches to the machine where the machine operator shakes the bunches into hulk hins.

With this procedure the ground men could not keep up. I installed a V-shaped slide on 1 side of the machine to allow direct delivery from 1 palm. With 2 men cutting in this palm, 1 of the ground men was eliminated. With 2 men in a palm close hy on the other side, 1 ground man could keep up. This system was not the most efficient, however, hecause each palm had to be climbed hy 2 men. Nevertheless, we averaged 23,000 pounds per day, or 396 pounds per man hour.

The good points of this machine are relatively low cost, dependahility, simplicity of operation, maneuverability, and ease in handling hins. It does have drawhacks. We still have to use ladders and have men who can handle them. Occasionally a hunch will he dropped and there is some spillage.

The cost of the present machine was less than $2,000. The men were paid by the hour plus an incentive. Savings can he made with the use of bins and a forklift. A truck driver can load by himself and swampers are not needed. A front or rear forklift attachment can be put on a tractor.

For this coming season I plan to build 1 or 2 additional units. They will be hasically the same, but will have a wide hydraulic powered and controlled conveyor belt on 1 side of the machine to bring the bunches to the machine operator. When the tree man has finished half of the tree, the belt can be raised, turned and lowered on the other side of the palm. I will mount 2 ladders on the machine. Men will still have to pull the ropes to raise the ladders, but will not have to balance or carry them. This will be a 3-man crew, but I believe that it will be so much more efficient that the output will be near that of the present machine with a crew of 6 or 7.

E. E. Smith: Several occurrences this year were unusual. First, we were expecting the loss of braceros and were slowed in mechanical harvesting; consequently, everyhody wanted to get as much fruit as possible harvested before the employment of hraceros was discontinued. Secondly, we had an unusually soft crop, high in naturals, that resulted in some mashed fruit, syruping, and, in fruit of very high moisture content, some fermentation. The loss may have been ½ to 1%. With the exception of these problems, mechanical harvesting last season was a very successful operation. Bins are necessary to mechanical harvesting. We spent much time trying to adapt shakers to the use of boxes, but we lost more dates than we collected in the boxes. The hins are essential to avoid excessive loss of fruit. The grower must see that the hins are properly placed before filling, however, so as to avoid having dirt and trash picked up with the bin by the forklift. We found that a great deal of dirt and trash was being dropped into some bins in the process of stacking the hins on the truck. The forks would enter the ground and pick up a load of dirt or trash that would be dropped in the bins below as it was placed on the stack. Perhaps a change in the design of the fork used in the field would reduce the amount of dirt and trash picked up during the loading operation.

With regard to packing plant operation, the use of bins was extremely satisfactory. With proper control of picking to avoid harvesting soft or green fruit, the flow of fruit to the packing lines was even and steady. We can use the hins for storage and transportation of graded fruit. The bin is a great labor-saving device in plant operation.

Q: Was there any damage to fruit picked early in the season?

A: The first pick was quite satisfactory. Later, toward the end of the hracero program, we began to realize that fruit was coming in too green and we had some difficulty with it.

Q: When fruit was left too long on the tree, was there trouble from tearing of the dry skin?

A: Yes, the fruit can become too dry. If the skin on the dates hecomes extremely dry, it will be shattered in the shaking and collecting operations.

Q: Did unpollinated fruit present a problem?

A: Yes, it has to he picked out hy hand from the grading belt in the packing house. Unpollinated fruit are obvious to the graders, however, and probably can be removed more cheaply in the packing house than in the field unless entire bunches can be eliminated in the field.

Q. Did unpollinated fruit ripen soft and syrupy?

A: The green fruit, pollinated or unpollinated became soft and syrupy when collected in a heavy mass. There was also some spoilage of wet fruit by yeasts. We used a modification of the citrus dumper developed by the Brogdex Co. for dumping the bins. From our experience this season I think we might favor Dr. Rygg's suggestion that we use 16-inch bins.

Q: Are you suggesting that we should not fill the hins? If we filled them ¾ full in the field, would this cause a prohlem in the packing house?

A: It depends on the quality and type of fruit handled. If the fruit is well cured, I anticipate no prohlem; hut if it is green, they should not he filled. If they are filled only ½ or ¾ full, ohviously more bins and more storage space will be needed. There is settling of fruit in the bins, so that ahout 20% of the space in bins can he filled in by adding fruit when the bins are placed in cold storage if the fruit is dry enough to allow filling. Bins coming from the field have settled 3 or 4 inches. The average weight of bins coming in from the field is 900 pounds. The tare is established, and the grower gets a per-pound-equity just as when the fruit was in lugs. The bins weigh approximate-

ly 130 pounds. Sampling from bins was quite satisfactory. The bin samplers were designed so that samples could be drawn from 4 different areas in the bin. As the bin was tipped over, any one of 4 tubes could be dialed and a sample core to the bottom of the bin be taken.

D. Mitchell: Mechanical harvesting was proved to be practical and more economical than the old way. The date industry will be better off if we can harvest nearly 100% of the crop mechanically and eliminate most of the hand work during this period of extreme labor shortage.

MEMBERSHIP ROLL — AUGUST 18, 1965

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Brown, T. R., Route 2, Box 81 ..... Thermal
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Gibbs & Newell, Box 647 ..... Thermal
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Jarvis & Gebhardt, Route 1, Box 181 ..... Thermal
Jarvis, E. C., Route 1, Box 180 ..... Thermal
Jenkins, Paul G., Box 661 ..... Indio
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Kitagawa, Paul, Route 2, Box 111 ..... Thermal
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Laflin, Ben, Jr., P. O. Box 757 ..... Thermal
La Quinta Hotel, Box 77 ..... La Quinta
Lauderbach, Leon W., 18252 Leon Way ..... Tustin
Leach, George H., Route 2, Box 115 ..... Thermal
Leslie Ranch Nurseries, Route 1, Box 51B ..... Indio
Lesser, Sol ..... Beverly Hills
Lindgren, David L., 4738 Elmwood Court .... Riverside
Longley, Dr. E. G., Route 2, Box 75 ..... Thermal
Loud, A. R., 1197 Loma Vista ..... Pomona
Lluvia De Oro Ranch—Irl H. Buxton, 4056 Williams Ave. ..... La Verne
Lundberg, Carl—Gold Acres, 924 B So. Orange Grove ..... Pasadena

Marshburn Farms, P. O. Box 529 ..... Norwalk
Marriott, Michael G., 12 Jarvis St., ... Alice Springs, Australia
Marx, Donald, 36940 Da Vall Rd ..... Cathedral City
McLeod, Norman, 1025 Olive Way ..... Palm Springs
Moran, Ronald E., 75-740 Highway 111 .. Palm Desert
Moschetti, Nick T., Box 245 ..... Rancho Mirage
Muhs, Arthur B., 904 Slavens Manor ..... Bentlendorf, Iowa

Naranjo, Dr. O. M., 1832 Maltman Ave .. Los Angeles
Netzley Bros., P. O. Box 343 ..... La Puente
Newcomer, Mrs. Lyle C., Sr., 1040 S. Orange Grove ..... Pasadena
Newsom, Willis—N & N Ranch 18-151 Williams Highway ..... Grants Pass, Oregon
Nixon, Roy W., U. S. Date & Citrus Station, 44-455 Clinton St. ..... Indio
Nusshaum, Vernon—American Date Garden, 2737 E. Coast Highway ..... Corona Del Mar

Odlum, Bruce W., Box 787 ..... Indio
Odlum, Floyd B., Box 787 ..... Indio
Olesen, Kay, P. O. Box 205 ..... Palm Desert
O'Rourke, Joseph, Route 1, Box 329 ..... Thermal

Patterson, K. K., 81-370 Date Palm Ave ..... Indio
Peck, Mrs. Albert, Box 908 ..... Palm Springs
Peter Rabbit Farms, Box 96 ..... Coachella
Pierson, Rollins, 7845 Torreyson Dr. ..... Los Angeles
Pinkley, Virgil M., P. O. Drawer NNN ..... Indio
Pinyan, R. A. and Margaret, 81-710 Miles Ave. ..... Indio
Pollock, Harry C., 300 Lincoln Bldg. ..... Cleveland, Ohio
Prairie Ave. Gospel Center, c/o Carl Pike, 930 S. Prairie Ave. ..... Hawthorne
Preston, Richard D., Box 66 ..... Coachella
Pryor, Anna K., 334 S. Detroit St. ..... Los Angeles
Puls, J. H. Ranch, 72-789 Bel Air Rd. ..... Palm Desert

Rancho Ramona, c/o Harboe Mng. Service, Box 116 ..... Indio
Rapkin, Joseph, 735 N. Water St..... Milwaukee, Wis.
Reuther, Dr. Walter, U. of Calif., Dept. of Hort. Science ..... Riverside
Richardson, H. B., Univ. of California, 2017 Horticultural Science Bldg. ..... Davis
Richert, H. C., Box 607 ..... Indio
Riverside Co. Agricultural Commissioner, 4060 Orange St. ..... Riverside
Robinson, Donald, 45-251 Palm Dr. ..... Indio
Rogers, David A., Route 1, Box 271..... Winterhaven
Rudd, Will D., 713 Rosecrans St. ..... San Diego
Rudey, E. D., 81-850 Ave. 50 ..... Indio
Rummonds Bros., Box 726 ..... Thermal
Ryals, William M., Box 35 ..... Palm Desert
Rygg, G. L., Box 700 ..... Pomona

S. & G. Ranch—G. K. Ranney, 11712 Lampson Ave. ..... Garden Grove
Schmid, Dorothy, Route 1, Box 35 ..... Coachella
Schmid, Henry M., Route 1, Box 35 ..... Coachella
Schmid, Thomas, Route 1, Box 35 ..... Coachella
Schmid, Walter, 7931 Lampson Ave. .... Garden Grove
Schuman Co., P. O. Box 670 ..... Beverly Hills
Schwartzburd, Martin, 11509 Duque Dr. ..... Studio City
Siemen, Fred, Box 44 ..... Palm Desert
Smart, Jackson W., 208 S. La Salle St, ... Chicago
Smead, Paul, P. O. Box 3921, Frere Hall ..... Karachi, Pakistan
Smigel, George B., 2017 Granville ..... Los Angeles
Smith, E. E., Box 1405 ..... Indio
Snow, Dr. Rodney H., 301-20th St. ..... Santa Monica
Soloro Ranch—Geo. H. Leach, Route 2, Box 115 ..... Thermal
Stock, Edward & Pat, Route 1, Box 186 ..... Thermal
Strehle, Joseph, 1338-21st St. ..... Longview, Wash.
Swingle, Mrs. Walter T., 1846 Spruce St. .... Berkeley

Thielemeir, Lawrence G., Box 265 ..... Santa Ana

Urick, W. E. Ranch, 2031 Dracena Dr. .... Los Angeles
U. S. Date & Citrus Station, 44455 Clinton St. .. Indio

Ward, Edith E., 73-661 Highway 111 .... Palm Desert
Waters, Norman A., 3240 Lakeshore Dr. .. Chicago, Ill.
Webb Farms, Inc., Route 2, Box 68 ..... Thermal
Webb, Robert W. Jr., 8 Warm Sands Pl. ..... Palm Springs
Weiner, Dr. Aaron, Box 638 ..... Indio
Westerfield, James P., Box 595 ..... Mecca
White, Hollis L., 40-755 Del Sol Rd..... Rancho Mirage
Wilson, Gwynn, 75075 Highway 111 ..... Palm Desert
Wisenant, J. B. ..... Palm Desert
Wooden Shoe Ranch—Bernard Van der Steen, Box 38 ..... Indio

Yanai, Zalman, Degania Beth, Emek Hayardin, ... Israel
Yost, Leland J., Route 2, Box 124 ..... Thermal

Zarakov, Stanley and Selma, 1630 S. Calle Marcus ..... Palm Springs